Scientific Opinion of EFSA SC

Recovery in environmental risk assessments at EFSA

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efsa
European Food Safety Authority

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BACKGROUND

Specific Protection Goals may be defined in terms of the '**ecological threshold option (ETO)**' or '**ecological recovery option (ERO)**'

- ETO: no ecologically relevant effects on non-target organisms permitted
  - *Ecological entities may concern individuals (vertebrates), populations (most invertebrates and plants), or functional groups (microbes)*
- ERO: some short-term and spatially restricted effects on non-target organisms are inevitable and permitted

BACKGROUND

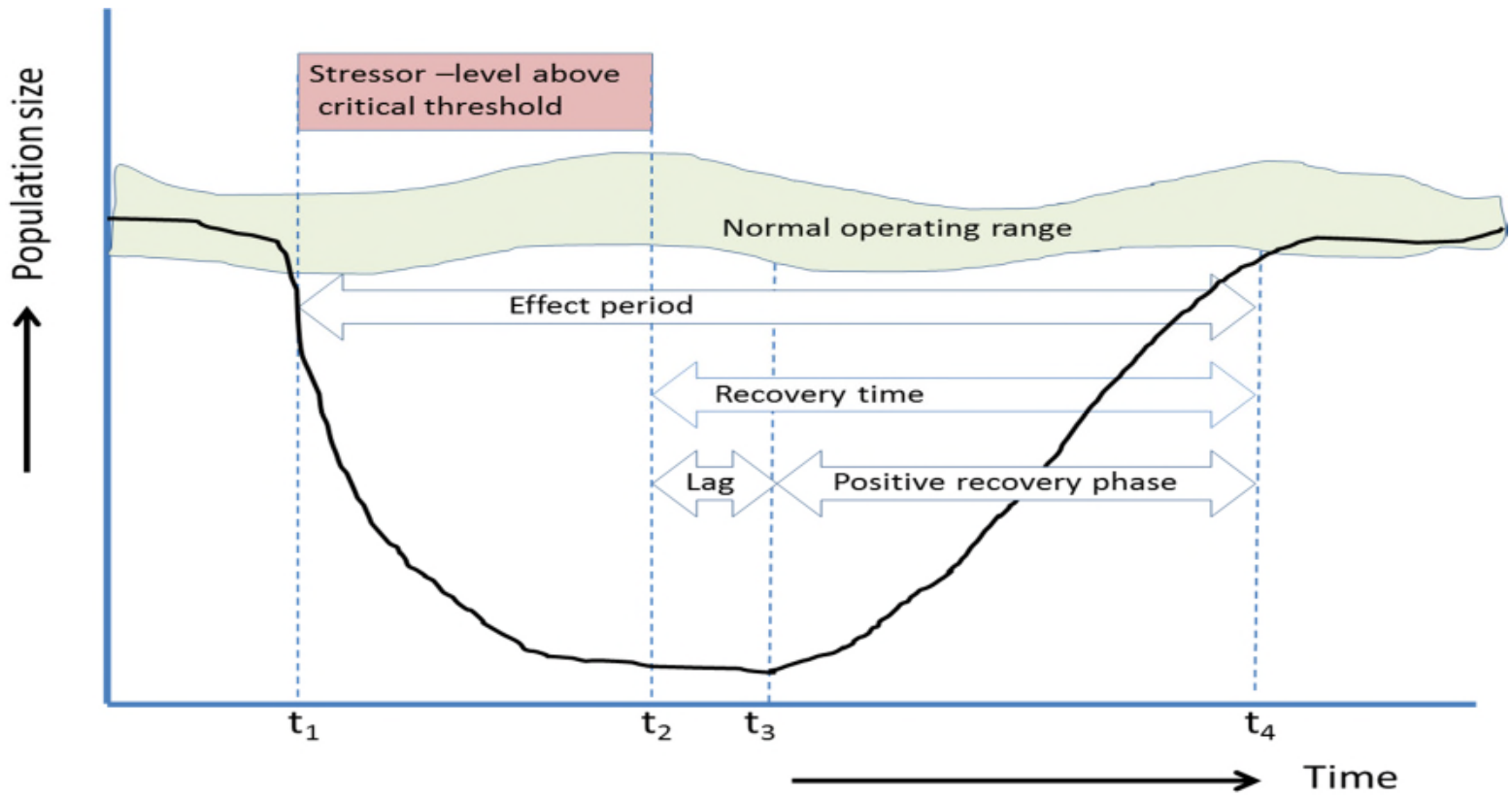
- Both the ETO and ERO options apply for Plant Protection Products
  - *Recovery option for **in-crop ERAs** and non-target invertebrates and plants in particular*
- ERO may be considered on a case-by-case basis for GMOs and Feed Additives
- For Invasive Alien Species harmful to plant health, ecological recovery is part of the scenario assumptions
- Overarching framework is required how to assess recovery

AIMS OF THE OPINION

- Gather scientific knowledge on ecological recovery for further development of ERAs
- Provide a conceptual approach to address ecological recovery in ERAs for all potential stressors that fall under the remit of EFSA
- Promote a dialogue between different panels of EFSA, risk assessors and managers and all relevant stakeholders

ECOLOGICAL RECOVERY

The return of the perturbed ecological endpoint to its normal operating range (usually after pulse disturbance)



PULSE AN PRESS DISTURBANCE

Pulse disturbance

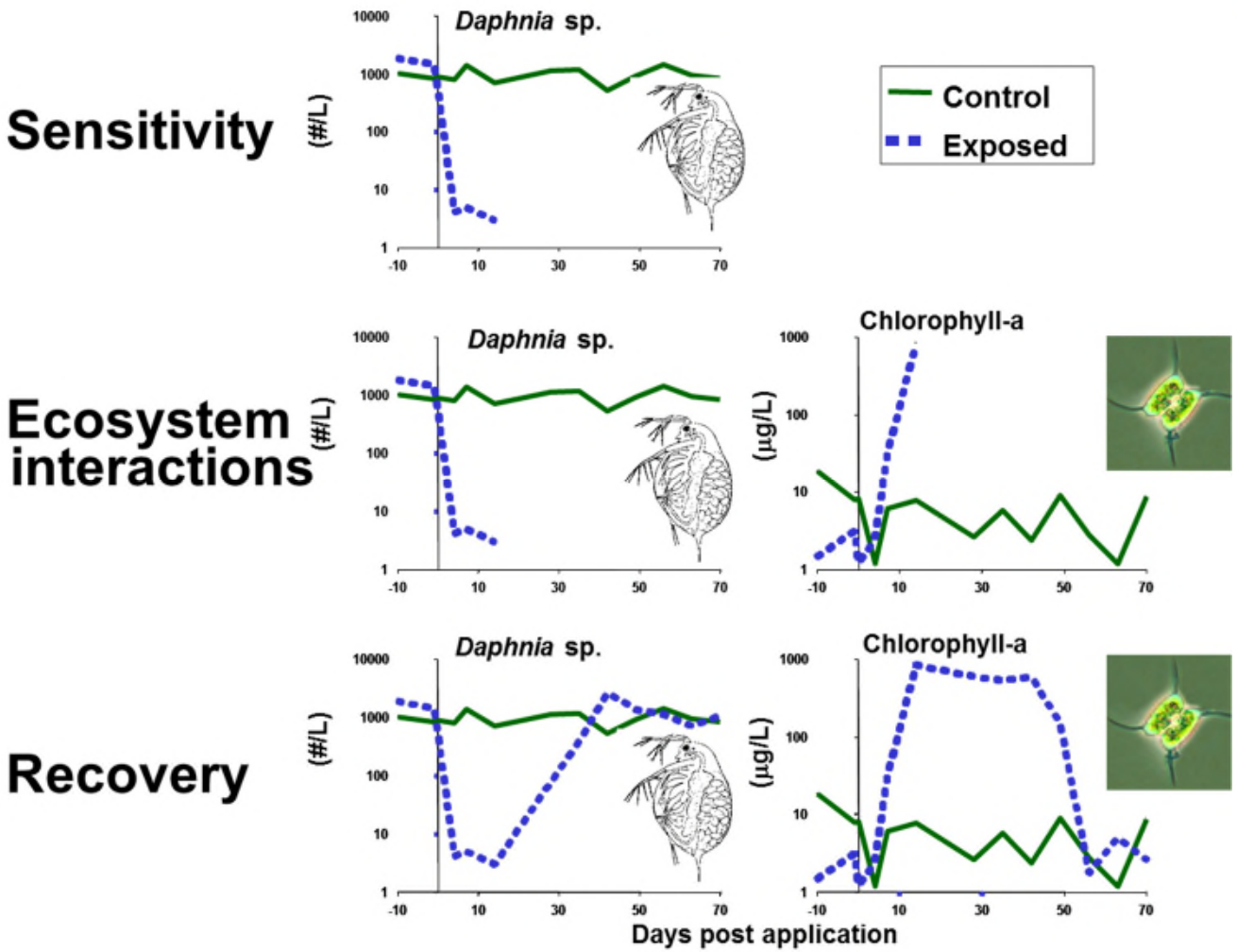
- A relatively short-lived disturbance (*e.g. a single exposure to a chemical with short half-life*)
- Ecological recovery may occur after its disappearance

Press disturbance

- A long-term response of an endpoint following exposure to a single (usually persistent) stressor or repeated exposure to one or more stressors
- Fast ecological recovery less likely
- Adaptation to the stressor(s) may occur (*process of adjustment to environmental stress*)

ECOLOGICAL RECOVERY

- Ecological recovery may concern both direct and indirect effects of the stressor
- Indirect effects may persist longer than direct effects



INTERNAL AND EXTERNAL RECOVERY

- Internal recovery
  - Facilitated by the *in situ* survival of individuals or resting propagules (e.g. seeds) and their subsequent growth, within the area affected by a stressor
- External recovery
  - Recovery governed by the immigration of individuals by active and passive dispersal

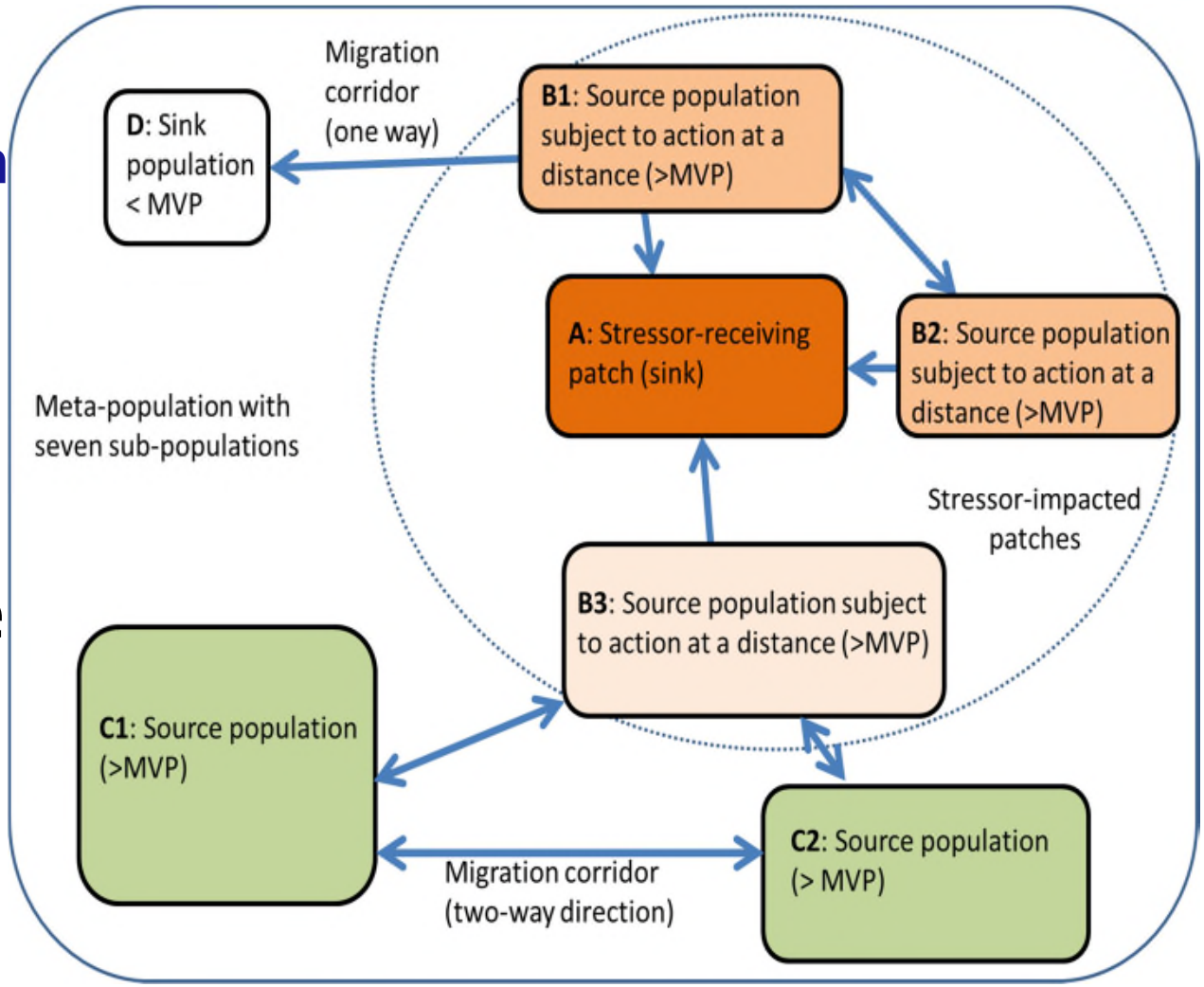
SINK AND SOURCE POPULATIONS

Metapopulation

= An overall population comprising populations of the same species connected through immigration and emigration

Action at a distance

= Effects of a stressor outside its area of exposure



SPECIES TRAITS AFFECTING RECOVERY

Life-history traits determining internal recovery:

- Voltinism (number of generations per year)
- Reproduction rate
- Resistant life stages
- Development time

Additional traits determining external recovery:

- Dispersal ability (active or passive)

Other important traits

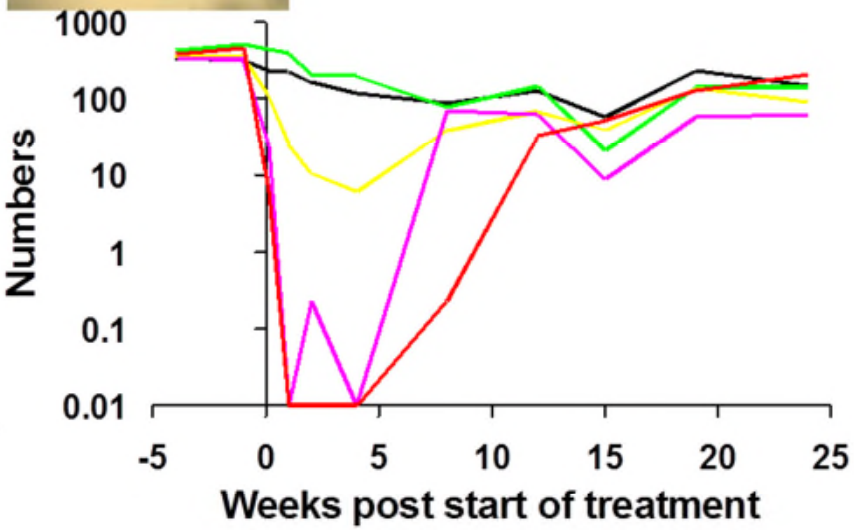
- Diet or foraging behaviour
- Genetic diversity / population fitness

In prospective ERA the selection of focal vulnerable taxa is key (realistic worst-case environmental scenarios)

SPECIES TRAITS AFFECTING RECOVERY

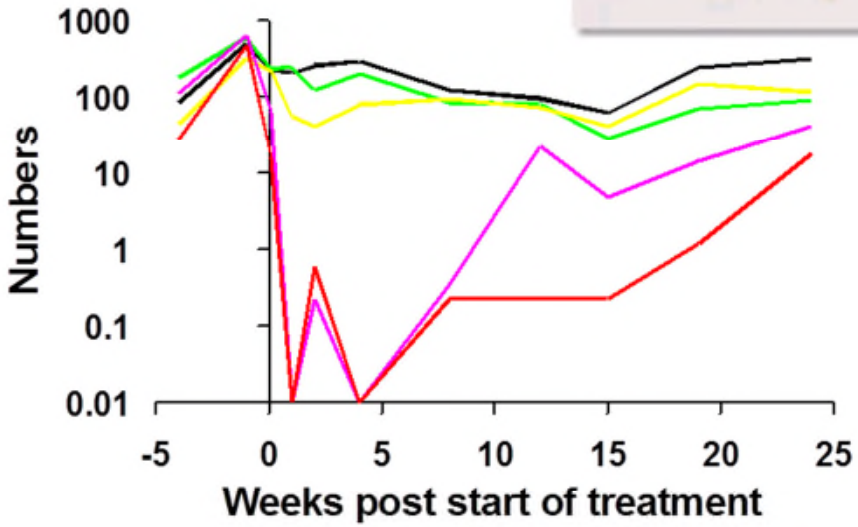
Two mayfly species

Cloeon dipterum



Relatively fast recovery
- appr. 3 generations/year
- egg deposition by terrestrial adults

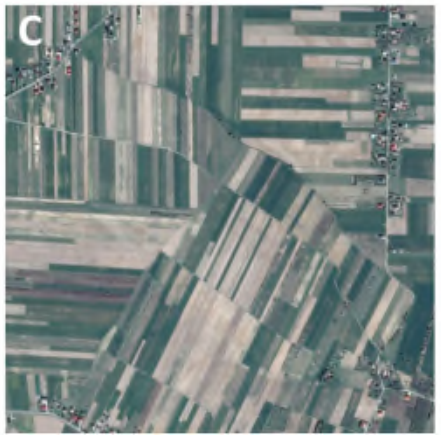
Caenis horaria



Relatively slow recovery
- 1 to 2 generations/year
- egg deposition by terrestrial adults

LANDSCAPE PROPERTIES AFFECTING RECOVERY

- Connectivity of habitats
- Spatial-temporal configuration of stressed and non-stressed (refuge) habitats



In prospective ERA the selection of focal landscapes is key (realistic worst-case environmental scenarios)

ECOLOGICAL RECOVERY AND EXTINCTION RISK

Possibility/ability to escape stressor in time

Long — Generation time — Short
Few — Number of offspring — Many
No — Resistant life stages — Yes
High — Stressor persistence — Low

High

Low

Internal recovery key
Local ERA
(Semi-)field experiments

Extinction risk low
Recovery option
always feasible

Focal communities, species & landscapes
Direct effects & ecological interactions

Recovery
option not feasible
Extinction risk high

External recovery key
Landscape ERA
Spatially structured
Population models

Low — High

Possibility/ability of species to escape stressor in space

Small	Individual home range	Large
Specialised	Habitat/food preference	Flexible
Small	Refuge connectivity/availibility	High
Large	Spatial scale of exposure	Small

Systems approach to address recovery

- Experimentation
- Modelling
- Monitoring

I: Supporting Information

Specific Protection Goal

- Recovery option feasible?
- Ecosystem services
- Dialogue between risk assessors and risk managers

Societal perspective

- Stakeholders' view
- Farmers' behaviour

Monitoring

- Monitoring of sensitive areas and population changes
- Monitoring of chemicals

Knowledge Base

- New scientific knowledge
- Observed system changes

II: Key Parameters

(Regulated) Stressors

- Toxicity, fate and usage information
- Multiple stressors

Focal Species

- Life-history (e.g. voltinism, habitat selection, phenology, dispersal characteristics)
- Vital rates (reproductive rates, mortality rates)
- Sensitivity to stressor

Focal Landscapes

- Climate, soil and hydrological information
- Landscape topography (incl. size and shape and coverage of fields and non-agricultural areas)
- Agronomic practices (crop diversity and rotation, crop husbandry, mitigation measures)

III: ERA Tools for Recovery

Development of environmental Scenarios

(Semi-)field Experiments.

- Comprising a sufficient number of sensitive and vulnerable species to assess recovery under realistic worst-case conditions, with respect to external recovery

Ecological Modelling

- Spatially explicit modelling to address action at a distance and integration of spatial and temporal dynamics in population recovery assessment.
- Spatially explicit fate modelling to assess relevant exposure endpoints.
- Food web modelling to explore indirect effects on population recovery.

Output verification

IV: Evaluation of potential conflicts with other Specific Protection Goals

- Are indirect effects possible that are in conflict with essential ecosystem services underlying other Specific Protection Goals?

THANKS FOR YOUR ATTENTION

Acknowledgement

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